

NOTES ON THE FRUIT FLIES (DIPTERA: TEPHRITIDAE) OF CALIFORNIA

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Abstract.—The tephritid fauna in California was studied in May and June 2002 on a two-week field trip and in September 2003 during a 16-day round trip through most of California. Records are given for 22 species of Tephritidae from 26 collection sites. Establishment of three introduced species, *Urophora jaculata* Rondani, *Terellia fuscicornis* (Loew), and *Chaetorellia succinea* (Costa), is verified. *Rhynencina longirostris* Johnson is reported from the western United States for the first time.

Key Words: Tephritidae, native, introduced species

The current knowledge of tephritid fruit fly species in California is based primarily on the long-term studies of Goeden and co-workers, who published a considerable number of papers on the biology and taxonomy of the native species. These works, along with Foote et al. (1993), were useful in developing and implementing field studies to determine the presence of purposefully and accidentally introduced tephritid species in California.

Nine tephritid species have been introduced into Canada and the USA since 1969. *Urophora jaculata* Rondani (misidentified as *U. sirunaseva*) was the first bioagent released to reduce yellow starthistle, *Centaurea solstitialis* L. (Maddox 1981), but it failed to establish (Julien and Griffiths 1999). *Urophora affinis* (Frauenfeld), *U. quadrifasciata* (Meigen), *U. sirunaseva* (Hering), *Chaetorellia australis* Hering, *C. acrolophi* White and Marquardt, and *Terellia virens* (Loew) were introduced from Europe as biological control agents against invasive thistle species. *Terellia fuscicornis* (Loew) was an accidental introduction into North America (White and Elson-Harris 1994) and *Chaetorellia succinea* (Costa)

was introduced, presumably as a contaminant of *C. australis*, into California for control of yellow starthistle, (Julien and Griffiths 1999). The main objective of the current study was to determine post-release establishment and geographic extent of the above-mentioned species by collecting on known host plants throughout California.

MATERIALS AND METHODS

Field collections of adult tephritids and their host plants were conducted throughout California, focusing on the southern and eastern portions in 2002, and the western, central, and southern portions in 2003. Collections were made in most major ecosystems in California and from sea level to over 1,500 m. Adult flies were collected by sweeping stands of knapweeds and/or thistles. Sites where tephritids were collected are given in Table 1. The numbers in parentheses in the specimen data sections refer to the collection numbers for the sites in the first column of Table 1. These sites are located along a 5,600 km route from Los Angeles to San Francisco along Hwy 1, then inland to Napa Valley. The northernmost site was Paskenta near Mendocino

Table 1. List of localities with dates and descriptions of collections.

Collection No.	Date	Locality
2002		
i	May 27	Riverside Co., Aguanga Rd near Hwy 79, Cleveland National Forest
ii	June 6	Mariposa Co., near Yosemite National Park, Hwy 120
iii	June 8	San Luis Obispo Co., ca. 1.6 km west from intersection of Hwy 101 and 166
iv	June 8	San Luis Obispo Co., ca. 8 km west from Santa Maria, Rd 166
v	June 8	Santa Barbara Co., New Cuyama, Rd 166 Ventucopa Rd 33
vi	June 8	San Bernardino Co., Pine Mountain, Summit, Rd 138
2003		
1	Sep 6	Ventura Co., Monte Pinos east from Lake of the Woods, east of Gorman (unpaved road)
2	Sep 7	San Luis Obispo Co., near Cambria on Hwy 46 about 16 km before Hwy 1
3	Sep 7	Monterey Co., Santa Lucia Mountains south of Los Padres Rd connecting Jolon to Hwy 1
4	Sep 7	Monterey Co., Santa Lucia, near the sea shore
5	Sep 8	Monterey Co., military area in marina close to Salinas
6	Sep 9	Sonoma Co., Sonoma Hwy 12
7	Sep 10	Lake Co., south from Clear Lake on Hwy 175 ca. 3 km from Hwy 101
8	Sep 10	Mendocino Co., exit Hwy 162 from Hwy 101
9	Sep 11	Butte Co., near Paradise on Hwy 70
10	Sep 13	San Joaquin Co., north of Clements on Hwy 88
11	Sep 13	Amador Co., Silver Lake, Eldorado National Forest
12	Sep 14	Madera Co., on Hwy 145 ca. 8 km from Madera
13	Sep 15	Kern Co., Caliente (about 50 km from Bakersfield) on Hwy 58
14	Sep 15	Kern Co., Tehachapi on Hwy 58
15	Sep 15	Kern Co., Theachapi city
16	Sep 15	Kern Co., hills on Hwy 202 ca. 16 km from Tehachapi
17	Sep 17	Riverside Co., on Hwy 86 ca. 3km beyond Indio
18	Sep 17	Imperial Co., Salton Sea near desert shores
19	Sep 17	San Diego Co., close to Hwy 78 and Rd S2 at the entrance to Anza Borrego National Park
20	Sep 20	Orange Co., San Juan Capistrano close to Hwy 74

National Forest. Sites were visited south through the San Joaquin Valley with short side trips into the Sierra Nevada Mountains. After crossing the Mohave Desert, the route continued across San Bernardino National Forest, down to the Salton Sea, over to Anza Borrego, and finally returning to Los Angeles (Fig. 1).

Collected fly specimens were pinned and identified using Foote et al. (1993). Voucher specimens are deposited in the Charles University Collection, Prague. Plant names follow Hickman (1993).

RESULTS AND DISCUSSION

A total of 53 specimens were collected in 2002, and 259 specimens were collected in 2003. Altogether 22 species were collected and identified, three of which were species introduced from Europe.

NATIVE SPECIES

Subfamily Tephritinae

Tribe Terelliini Hendel

Neaspilota signifera (Coquillett).—Near Paradise at Hwy 70 (9), Sep 11, 2003, 5 ♀;



Fig. 1. Map of California showing collection localities. * = collections in 2002, o = collections in 2003.

north of Clements at Hwy 88 (10), Sep 13, 2003, 1 ♀; at Hwy 145 ca. 8 km from Madera (12), Sep 14, 2003, 3 ♂, 2 ♀; hills at Hwy 202 ca. 16 km from Tehachapi (16), Sep 15, 2003, 1 ♀.

This is the only species in the genus lacking supra-alar bristles. Two host plants were recorded by Freidberg and Mathis (1986), *Baeria Fremontii* Hoover and *Hemizonia pungens* (Hook & Arn.) Torr. & A. Gray. Adult flies were swept from dry plants close to Paradise and Clements bordering Camanche National Forest. Five specimens were collected north of Fresno, near Madera, and one specimen on the hills at Hwy 202 near Tehachapi. *Neaspilota signifera* is a commonly collected species in California.

Neaspilota wilsoni Blanc and Foote.—Santa Maria Hwy close to Hwy 166 and Hwy 101, (iii), Jun 8, 2002, 1 ♂; Santa Lucia Mountains south of Los Padres Rd connecting Jolon to Hwy 1 (3), Sep 7, 2003, 3 ♂, 2 ♀.

This species was collected only at two localities. The only known host plant is *Haploppapus squarosus* (Hook & Arn.) = *Hazardia squarrosa* (Hook & Arn.) E. Greene. *Neaspilota wilsoni* is not as common as *N. signifera*, and was collected at the only previously known locality (Foote et al. 1993). The species is considered univoltine; adults occur from June to August, but sometimes with a partial second generation (Goeden and Headrick 1999). Specimens were collected in August 2002 and September 2003, so apparently a second generation developed in 2003.

Tribe Myopitini Bezzi

Rhynencina longirostris Johnson.—Santa Lucia Mountains south of Los Padres Rd connecting Jolon to Hwy 1 (3), Sep 7, 2003, 1 ♂.

Rhynencina is easily distinguished from other North American genera by the face in lateral view is slanted forward at an angle to the vertical axis of the head, and the anterior oral margin produced anteriorly well beyond the anterior margin of the parafacial

(Foote et al. 1993). The only known host plant, *Smallanthus uvedalius* (L.) Mackenzie ex. Small (Asteraceae), was only recently discovered by Steck et al. (2003).

This collection represents a new species and genus record for California. The previously known distribution included only the eastern states of Georgia, North Carolina, Pennsylvania, and Maryland.

Tribe Dythricini Hendel

Subtribe Cecidocharina Hering

Procecidochares spp.—*P. minuta* (?) Tehachapi at Hwy 58 (14), Sep 15, 2003, 1 ♀; *P.* (?) sp., a small species with yellow femora, Salton Sea Lake near desert shore (18), Sep 17, 2003, 1 ♂, 1 ♀.

This is a species-rich genus in the United States, but the specimens collected in the current study were not determined to species level because of their poor condition and because of the many sympatric or cryptic species.

Tribe Tephritini

Dioxyna picciola (Bigot).—Santa Lucia, near the seashore (4), Sep 7, 2003, 1 ♂.

This is one of two American species in this genus. It is widespread with a cosmopolitan distribution and recorded from 21 host plant species in five genera.

Euaresta stigmatica Coquillett.—Caliente (about 50 km from Bakersfield) at Hwy 58 (13), Sep 15, 2003, 10 ♂, 6 ♀; Salton Sea Lake near desert shore (18), Sep 17, 2003, 1 ♂; close to Hwy 78 and Road S2 at entrance to Anza Borrego National Park (19), Sep 17, 2003, 6 ♂.

The specimens were collected on *Ambrosia* spp. in September 2003. Both the fly and host plants are common in California. The fly is bivoltine and adults occur from mid-June to late September (Headrick et al. 1995).

Neotephritis finalis (Loew).—Yosemite Rd on Hwy 20 (ii), Jun 1, 2002, 1 ♂, 2 ♀.

Neotephritis finalis is the most commonly encountered tephritid in the United States and Canada (Foote et al. 1993). Two spe-

cies of *Neotephritis* occur in the United States, *N. finalis* and *N. rava* Foote, and they easily can be recognized by the color of scutum, and distinct or indistinct wing pattern, respectively (Foote et al. 1993).

Campiglossa genalis (Thomson).—Military area in marina close to Salinas (5), Sep 8, 2003, 31 ♂, 12 ♀; Sonoma Hwy 12 (6), Sep 9, 2003, 2 ♂, 1 ♀.

Campiglossa genalis is a widespread species recorded from Canada, e.g., from British Columbia, Alberta, and Saskatchewan (Foote et al. 1993), on a variety of host plants in the genera *Haplopappus*, *Senecio*, *Eriophyllum*, *Layia*, *Madi*, and *Venegasia*. It was collected in great numbers on *Haplopappus* spp. at both localities. The species is multivoltine and very common (Goeden et al. 1994).

Campiglossa variabilis (Doane).—Fish Camp, close to Yosemite National Park (ii), Jun 6, 2002, 1 ♂.

This specimen was collected at a high elevation near Yosemite National Park, as also reported in Foote et al. (1993).

Tephritis araneosa (Coquillett).—Santa Lucia Mountains, near the seashore (4), Sep 7, 2003, 4 ♂, 4 ♀; Silver Lake, Eldorado National Forest (11), Sep 13, 2003, 4 ♂.

This is the nominate species of the *araneosa* complex (*araneosa*, *signatipennis*, *candidipennis*, *leavittensis*, and *ovatipennis*) and a very common species in California.

Tephritis californica Doane.—Near Cambria at Hwy 46 about 16 km before Hwy 1 (2), Sep 7, 2003, 1 ♂.

Only one specimen was swept in the Santa Lucia Mountains on its known host plant, *Baccharis* sp.

Tephritis ovatipennis Foote.—Monte Pinos (1), Sep 6, 2003, 1 ♂; Silver Lake (11), Sep 13, 2003, 2 ♂, 4 ♀.

This is closely related to but not as common as *T. araneosa*. The only known host plants belong to the genera *Corethrogyne* and *Erigeron*.

Tephritis signatipennis Foote.—Monte Pinos (1), Sep 6, 2003, 1 ♂; Silver Lake,

Eldorado National Forest (11), Sep 13, 2003, 1 ♂, 2 ♀.

Tephritis signatipennis is closely related to *T. araneosa*, also collected at the same localities. Specimens were collected only at sites within its currently known distribution. The only known host plant is *Machaeranthera canescens* (Pursh) Gray (Wasbauer 1972), that usually only grows at high elevations. All three *Tephritis araneosa* complex species were collected at the same locality at Silver Lake ca. 2,000 m.

Tephritis stigmatica (Coquillett).—Aguanga Rd near Hwy 79, Cleveland National Forest (i), May 29, 2002, 3 ♂, 2 ♀.

Five specimens were collected as pupae in flower heads, but the host plant was not determined; reared on June 3, 2002.

Trupanea bisetosa (Coquillett).—Caliente (about 50 km from Bakersfield) at Hwy 58 (13), Sep 15, 2003, 1 ♂.

This species was collected on *Helianthus* sp. It is a common species in this part of California. A closely related species, *T. nigricornis*, is sympatric in southern California, but they differ in ecological characteristics, such as oviposition behavior, whereby females oviposit different number of eggs at different sites in different developmental stages of flower heads (Knio et al. 1996).

Trupanea californica Malloch.—Santa Lucia Mountains south of Los Padres Rd connecting Jolon to Hwy 1 (3), Sep 7, 2003, 1 ♂; military area in marina, close to Salinas (5), Sep 8, 2003, 1 ♂; exit Hwy 162 from Hwy 101 (8), Sep 10, 2003, 1 ♂, 1 ♀.

Trupanea californica was collected at three localities, two with host data: Santa Lucia Mountains on plants in the genus *Gnaphalium* and close to Salinas on *Gnaphalium* sp. The species is widely distributed through California. It is a multivoltine, nondiapausing, and oligophagous species in California (Headrick and Goeden 1991).

Trupanea femoralis (Thomson).—Near Yosemite National Park, Rd 120 (ii), Jun 1, 2002, 1 ♂, 3 ♀; Santa Lucia, near the seashore (4), Sep 7, 2003, 5 ♀; Paradise at

Hwy 70 (9), Sep 11, 2003, 4 ♀; north of Clements at Hwy 88 (10), Sep 13, 2003, 5 ♀; Caliente, about 50 km from Bakersfield at Hwy 58 (13), Sep 15, 2003, 1 ♀; San Juan Capistrano close to Hwy 74 (20), Sep 20, 2003, 1 ♂, 1 ♀.

Specimens were collected near the coast and at higher altitudes near Paradise, Clements, and Tehachapi. The fly is a common species in this part of California with many host plants.

Trupanea jonesi Curran.—Silver Lake, (11), Sep 13, 2003, 3 ♂, 1 ♀.

This is a polyphagous species with host plants from 29 genera and is considered one of the more common tephritid species in California.

Trupanea nigricornis (Coquillett).—Tehachapi city (15), Sep 15, 2003, 1 ♀; hills at Hwy 202 ca. 16 km from Tehachapi (16), 1 ♀; at Hwy 86 about 3 km beyond Indio (17), Sep 17, 2003, 1 ♂; close to Hwy 78 and Rd S2 at the entrance to Anza Borrego National Park (19), Sep 17, 2003, 1 ♂, 1 ♀.

This species was collected at three localities in close proximity.

Trupanea wheeleri Curran.—Monte Pinos (1), Sep 6, 2003, 1 ♂; Tehachapi at Hwy 58 (14), Sep 15, 2003, 2 ♂, 3 ♀; hills at Hwy 202 ca. 16 km from Tehachapi (16), Sep 15, 2003, 10 ♂, 8 ♀; San Juan Capistrano close to Hwy 74 (20), Sep 20, 2003, 1 ♀.

At one locality, Monte Pinos, specimens were taken from *Chrysothamnus viscidiflorus* (Hook.) Nutt., one of its known host plants, which was abundant and blooming.

INTRODUCED SPECIES

Chaetorellia succinea (Costa).—Twenty-six specimens were collected in 2002, and 176 specimens in 2003. This species was also found at several more localities (not included in Table 1) with high abundance of *Centaurea solstitialis*: San Luis Obispo Co., San Luis Obispo, May 4, 2002, 2 ♀; Morro Bay Hwy 41, Jun 7, 2002, 3 ♂, 3 ♀; Atascadero Hwy 41, Jun 7, 2002, 1 ♂, 3 ♀; Santa Maria Rd 166 (iii), Jun 8, 2002, 5 ♂, 2 ♀; Santa Maria Hwy (iv), Jun 8,

2002, 1 ♂, 2 ♀; New Cuyama Rd 166 (v), Jun 8, 2002, 1 ♂, 3 ♀; near Cambria at Hwy 46 about 16 km before Hwy 1 (2), Sep 7, 2003, 1 ♂; Santa Lucia Mountains south of Los Padres Rd connecting Jolon to Hwy 1 (3), Sep 7, 2003, 2 ♂; Santa Lucia, near the seashore (4), Sep 7, 2003, 6 ♂, 4 ♀; Sonoma Hwy 12 (6), Sep 9, 2003, 4 ♂, 2 ♀; south from Clear Lake at Hwy 175 ca. 3 km from Hwy 101 (7), Sep 10, 2003, 24 ♂, 14 ♀; north of Clements at Hwy 88, several stops on the way (10), Sep 13, 2003, 36 ♂, 14 ♀; Silver Lake, Eldorado National Forest (11), Sep 13, 2003, 22 ♂, 3 ♀; at Hwy 145 ca. 8 km from Madera (12), Sep 14, 2003, 3 ♂; Caliente (about 50 km from Bakersfield) at Hwy 58 (13), Sep 15, 2003, 1 ♂, 2 ♀; Tehachapi at Hwy 58 (14), Sep 15, 2003, 15 ♂, 12 ♀; Tehachapi city (15), Sep 15, 2003, 5 ♂, 3 ♀; hills at Hwy 202 ca. 16 km from Tehachapi (16), Sep 15, 2002, 2 ♀; Salton Sea Lake near desert shore (18), Sep 17, 2003, 1 ♂.

In the early seventies, *Chaetorellia australis* and *Urophora sirunaseva* were purportedly released as biological control agents against yellow starthistle, *Centaurea solstitialis*, and were established in several states (Turner et al. 1995). Balciunas and Villegas (2001) studied this species and learned that it established on yellow starthistle only at sites where the alternative host plant, bachelor button (*Centaurea cyanus*), was also present. However, they did recover *Chaetorellia* flies at many sites where bachelor button was absent. Later, those adult specimens were identified as *Chaetorellia succinea*. In this study, the widespread distribution of *C. succinea* through California is confirmed on its host plant *Centaurea solstitialis*.

Urophora jaculata Rondani.—Santa Maria Rd 166 (iv), Jun 8, 2002, 4 ♂, 1 ♀; New Cuyama Rd 166 Ventucopa Rd 33 (v), Jun 8, 2002, 3 ♂, 1 ♀; Pine Mountain Summit (vi), Jun 8, 2002, 1 ♂, 2 ♀; south from Clear Lake at Hwy 175 ca. 3 km from Hwy 101 (7), Sep 10, 2003, 1 ♀.

Urophora jaculata was introduced into

California in 1969 for the control of yellow starthistle *Centaurea solstitialis*, but it failed to establish (Maddox 1981). At that time it was mistakenly identified as *U. sirunaseva* (Julien and Griffiths 1999). Twelve specimens were collected randomly in June 2002 and one female was collected near Kelseyville on highway 175, 3 km from Hwy 101, in 2003.

Terellia fuscicornis (Loew).—Santa Maria w of intersection at Hwy 166 and Hwy 101, (iii), Jun 8, 2002, 1 ♂, 1 ♀.

This species was accidentally introduced and has been spreading naturally throughout the range of its host, *Cynara cardunculus* L., causing significant damage (Julien and Griffiths 1999). Larvae also are reported to develop in the flower heads of *Silybum marianum* (Woods et al. 1996). This fly has not been purposefully released for biological control.

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